

## Nationwide study of publication misrepresentation in applicants to residency

Lara Sater,<sup>1</sup> Joseph S Schwartz,<sup>2</sup> Sarah Coupland,<sup>3</sup> Meredith Young<sup>4,5</sup> & Lily H P Nguyen<sup>2,5</sup>

**OBJECTIVES** This study was conducted to assess the prevalence of research publication misrepresentation amongst Canadian Resident Matching Service (CaRMS) applicants to a single surgical subspecialty residency as a potential means of assessing professional behaviour.

**METHODS** The authors reviewed CaRMS application forms to Canadian otolaryngology residency programmes over a 3-year period (2006–2008) for peer-reviewed publications reported as ‘published’, ‘accepted’ and ‘in press’. Citations were verified by searching PubMed, Google Scholar and electronic journals. Misrepresentation was defined as any of: (i) falsely claimed authorship of an existing article; (ii) claimed authorship of a non-existing article, and (iii) improper ordering of authorship. Outcomes included descriptive statistics, as well as sub-analyses pertaining to age, gender, affiliated medical school and academic degree, and number of publications per applicant.

**RESULTS** A total of 427 peer-reviewed publications were reported by 124 of 182 applicants (68% of applicants reported at least one publication). Of the 385 verifiable publications, 47 (12% of articles) were misrepresented by 29 applicants (23% of applicants claiming publication) self-reporting at least one publication. Age, gender, location of medical training, prior academic degree and number of citations per applicant did not relate to likelihood of misrepresentation ( $p > 0.05$ ).

**CONCLUSIONS** This study documents the nationwide prevalence of publication misrepresentation amongst applicants to Canadian otolaryngology residency programmes. The high rate of misrepresentation aligns with data reported in the literature and highlights the need to institute measures to dissuade graduates from this form of unprofessional behaviour.

*Medical Education* 2015; 49: 601–611

doi: 10.1111/medu.12729

Discuss ideas arising from the article at  
[www.mededuc.com/discuss](http://www.mededuc.com/discuss).



<sup>1</sup>Department of Family Medicine, University of Ottawa Health Services, Ottawa, Ontario, Canada

<sup>2</sup>Division of Head and Neck Surgery, Department of Otolaryngology, McGill University, Montreal, Quebec, Canada

<sup>3</sup>Department of Psychology, Simon Fraser University, Vancouver, British Columbia, Canada

<sup>4</sup>Department of Medicine, McGill University, Montreal, Quebec, Canada

<sup>5</sup>Center for Medical Education, McGill University, Montreal, Quebec, Canada

*Correspondence:* Lara Sater, University of Ottawa Health Services, Family Health Organisation, 300-100 Marie Curie PVT, Ottawa, Ontario K1N 6N5, Canada. Tel: 00 1 613 564 3950; E-mail: [lara.sater@hotmail.com](mailto:lara.sater@hotmail.com)

---

 INTRODUCTION

Professionalism has been identified as one of the core physician competencies essential to the optimal delivery of medical care by both the Canadian Medical Education Directives for Specialists (CanMEDS) framework and the Accreditation Council for Graduate Medical Education (ACGME).<sup>1,2</sup> Professionalism in medicine is a multidimensional competency broadly defined by Epstein and Hundert as: ‘the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served.’<sup>3</sup> Professionalism, as articulated by Cruess *et al.*,<sup>4</sup> is comprised of two principal elements: ‘a possession of a specialised body of knowledge and a commitment to service.’

Regrettably, unprofessional behaviour amongst practising physicians remains a concern and appears to relate to earlier misconduct during medical school.<sup>5</sup> In a case–control study of 235 medical graduates disciplined by a state medical board, the need for disciplinary action was found to be three times more likely amongst individuals who had exhibited unprofessional behaviour during medical school.<sup>5</sup> Given the potential impact of professional misconduct in medicine, it has become the responsibility of residency programme selection committees to appropriately screen potential candidates for professional integrity and appropriate professional behaviours, amongst other characteristics. However, objectively gauging unprofessional behaviour in medical students is challenging as professional behaviours, and the definition of professionalism, may vary substantially based on context.<sup>6–10</sup> Indeed, numerous studies have attempted, with limited success, to explore the reliability and validity of certain tools in evaluating medical professionalism.<sup>6–9</sup> Professional integrity is one aspect of professional behaviour that has been previously assessed<sup>9</sup> and it has been suggested that the accuracy of applicants to postgraduate medical programmes in self-reporting their scientific publication histories is representative of their professional integrity. In fact, the documented prevalence of publication misrepresentation varies widely in the literature, with estimates in several single-institution studies across various medical disciplines ranging from 1.8% to 37.6% of residency applicants who claimed at least one publication (Table S1, online).<sup>11,12</sup>

One caveat of previous findings is that they are typically limited to applicants to a single institution (Table S1). Here, we expand current work to explore patterns of publication misrepresentation in a nationwide pool of applicants to a single postgraduate residency discipline (otolaryngology–head and neck surgery [otolaryngology–HNS]) in Canada. The present study comprised an analysis of all applicants to a single subspecialty across all Canadian medical schools over 3 years and aimed to determine rates of publication misrepresentation. Secondary analyses explored applicant characteristics associated with publication misrepresentation.

---

 METHODS

**Data source: nationwide standardised electronic records**

Medical graduates apply annually to their Canadian residency programmes of choice through the Canadian Resident Matching Service (CaRMS). Similarly to the Electronic Residency Application Service (ERAS) in the USA, CaRMS provides a standardised electronic application form requesting details of the applicant’s education, as well as his or her clinical, academic and extracurricular involvement. Although much of the information provided by the applicant is confirmed through written documentation from a third party (e.g. university transcript, dean’s letter, letters of recommendation from clinical elective supervisors), a portion of the application consists solely of self-reported material. This largely refers to research activities, scientific publications and extracurricular activities.<sup>13</sup>

In the publication section of the CaRMS application form, candidates are requested to provide full citations for self-reported publications. Candidates may also list unpublished manuscripts in this section of the application while specifying their current status (e.g. in press, accepted for publication, under review, submitted). This self-reported publication section served as the main source of data for this study (articles reported as published, in press or accepted for publication).

**Ethics approval, confidentiality contract and data disclosure**

Ethical approval was obtained through McGill University’s Institutional Review Board, as well as CaRMS. A data licensing agreement outlining the terms of provision and the use of data was then

signed by the senior author (LHPN) and a CaRMS research committee representative. A confidentiality contract between CaRMS and a designated 'contractor' (SC) responsible for reviewing the de-nominalised data was also signed.

Access was then granted solely to research citations listed in the publication section for all applicants to Canadian otolaryngology–HNS residency programmes during 2006–2008. We chose to study applicants to otolaryngology–HNS because entry to these programmes is competitive (this is the second most competitive specialty after plastic surgery; 66% of applicants whose first-choice specialty is otolaryngology–HNS are matched to the specialty) and its cohort of applicants is smaller, which renders manageable the review of applications over several years to all programmes in Canada.<sup>14</sup> There are currently 13 otolaryngology–HNS residency programmes and 17 medical schools in Canada.

As most studies have reviewed applications over a year, we sought to examine the generalisability of previous findings by reviewing applications over a 3-year period. However, the year of application was withheld and data were conglomerated and randomly ordered as they were released from CaRMS in the interest of preserving applicant anonymity. To allow an adequate period for publication delay, our study referred to residency applications made at least 5 years prior to the start of our data collection.

Additional demographic data for each applicant were also released by CaRMS. These included details on age, gender, affiliated medical school and additional academic degree(s). In order to further maintain confidentiality, age groups (grouped in 5-year intervals) were provided instead of the applicants' exact ages.

In order to avoid any conflicts of interest and limit the possibility that applicants might be recognised by the reviewer, a non-medically affiliated third-party researcher (SC) was assigned the task of application review and data compilation (literature search and publication validation). The data collected (verification of self-reported publications and applicant characteristics) were subsequently coded to ensure anonymity. The remainder of the authors were at no point made aware of any names or corresponding demographic information for any of the applicants for whom data were provided by CaRMS.

### **Inclusion and exclusion criteria**

Applications to CaRMS were reviewed for self-reported peer-reviewed publications indicated as 'published', 'accepted for publication' and 'in press'. Manuscripts 'in preparation', 'in process', 'submitted for publication' or otherwise not specified, abstracts, presentations, posters and book chapters were excluded from analysis.

### **Definition of the misrepresentation of publications**

Publication misrepresentation was defined as: (i) non-authorship of an existing article (i.e. an article with the title reported by the candidate, published in the journal reported by the candidate was identified, but the candidate was not indexed as an author); (ii) claimed authorship of a non-existing article in a verifiable journal (i.e. no article with a matching title could be found in the journal reported by the candidate), or (iii) the self-promotion of the applicant's name in the author list (i.e. the candidate reported his or her name as appearing earlier in the author list than it did in the identified published article).

### **Publication review search protocol**

Citations were verified by searching the MEDLINE and PubMed databases, as well as the online search engine Google Scholar. If searching failed to yield the cited publication, a specific review of the electronic journal of the applicant-reported publication was undertaken. Articles that still were not verified were submitted to a subsequent search by a professional medical librarian.

Publication searches employed all available information (i.e. author name, article title and journal citation information) individually and in combination. Translated citations that could not be found and articles published in inaccessible journals (i.e. journals that were not available online) were excluded from analysis. The existence of inaccessible journals was confirmed by searching Ulrich's Periodicals Directory (UPD). This directory contains information on regularly published and irregularly issued serials throughout the world and is considered the definitive reference on the existence of journals. The most recent article search took place in October 2013, 5–7 years after residency applications were submitted (Fig. S1, online).

## Statistical analysis

Depending on the specific analysis, analyses focused on either applicant (one who did or did not misrepresent publications) or article (an article that was or was not misrepresented). Statistical analyses were performed using IBM SPSS Statistics for Windows Version 22.0 (IBM Corp., Armonk, NY, USA). The prevalence of publication misrepresentation was determined using the definitions described above. Independent two-sample *t*-tests were employed to evaluate the relationships between publication misrepresentation and age, gender, location of medical training (Canadian or international) and other academic degrees obtained (e.g. MSc, PhD). An association between publication misrepresentation and number of reported citations was assessed using the chi-squared test. A sub-analysis of location of medical training (Canadian medical graduate [CMG] or international medical graduate [IMG]) was also conducted. Multivariate analysis was performed using a logistic regression model. For all analyses performed, a *p*-value of < 0.05 was considered to indicate statistical significance.

## RESULTS

### Unverifiable publications

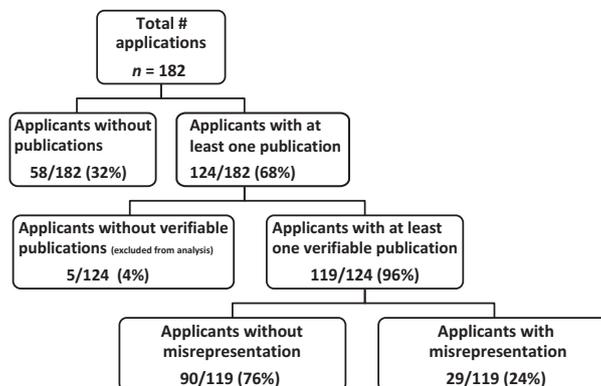
There were a total of 182 applicants to Canadian otolaryngology–HNS residency programmes over the 3-year study period, of whom 124 claimed to have had one or more publications. Fifteen applicants reported unverifiable citations. Five of those 15 candidates, all IMGs, reported no other verifiable

publications and their data were therefore excluded from analysis (Fig. 1).

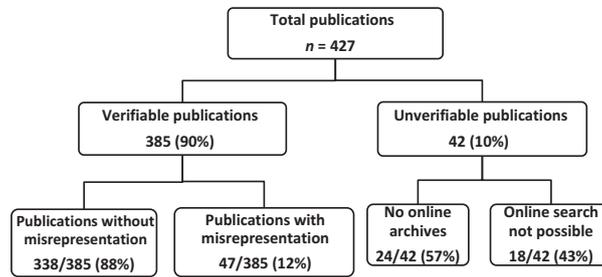
A total of 427 publications were reported, of which 269 were claimed by CMGs and 158 by IMGs. Of the total number of publications claimed, 385 were verified and 42 (10%) were unverifiable using the search strategy described. Of the unverifiable articles, 24 (57%) were unverifiable because no online archives for the listed journals were found. Of the latter publications, 17 were reported as published in 11 journals not listed in the UPD. For the remaining 18 unverifiable references, online searches were unsuccessful as only the English translation of the citation's title was provided (Fig. 2). Four of the 269 (1.5%) publications claimed by CMGs were unverifiable, compared with 38 of the 158 (24%) publications claimed by IMGs.

### Publication reporting and prevalence of misrepresentation

A total of 119 applicants reported at least one verifiable article; the mean  $\pm$  standard deviation number of articles per applicant was  $3.52 \pm 3.68$  (range: 1–25). Of the 119 candidates citing at least one verifiable publication, 29 (24%) misrepresented a total of 47 of 385 (12%) verifiable publications (Figs 1 & 2). Of the 29 candidates with at least one verifiable publication who misrepresented their publication history, more than half misrepresented all of the citations they claimed (Fig. S2, online). Numbers of misrepresentations and applicants committing them, organised according to type, can be found in Table 1. The table shows that individual applicants did not employ more than one of the three types of misrepresentation.



**Figure 1** Publication misrepresentation among Canadian Resident Matching Service (CaRMS) 2006–2008 applicants to otolaryngology–head and neck surgery residency programmes



**Figure 2** Prevalences of misrepresented publication citations among Canadian Resident Matching Service (CaRMS) 2006–2008 applicants to otolaryngology–head and neck surgery residency programmes

*Table 1* Numbers of applicants who misrepresented and misrepresentations organised by type among Canadian Resident Matching Service (CaRMS) 2006–2008 applicants to otolaryngology–head and neck surgery residency programmes

Type of misrepresentation	Applicants who misrepresented (n = 29/119) n (%)	Misrepresented publications (n = 47/385) n (%)
1 Non-existing article	21 (72)	38 (81)
Claimed as 'published'		28 (60)
Claimed as 'in press'/'accepted for publication'		10 (21)
2 Authorship self-promotion	7 (24)	8 (17)
3 Non-authorship	1 (3)	1 (2)

**Misrepresentation trends among applicants with verifiable publications**

Age ( $p = 0.97$ ), gender ( $p = 0.25$ ), location of medical training ( $p = 0.10$ ) and prior academic degrees ( $p = 0.42$ ) did not relate to publication misrepresentation (Table 2). Despite the lack of statistical significance, a notably higher number of the 29 applicants misrepresenting their publication histories were CMGs ( $n = 25, 86\%$ ) than IMGs ( $n = 4, 14\%$ ) (Table 2). When misrepresentation rates were portrayed relative to cohort, CMGs maintained a higher rate of misrepresentation than IMGs (Fig. 3).

Although applicants with graduate degrees comprised a minority ( $n = 2$ ) of the applicant pool ( $n = 119$ ), it is worth noting that neither of these applicants misrepresented any citations (Table 2).

Similarly, a comparison between applicants who did and did not misrepresent their publication histories showed no significant difference between the numbers of citations claimed by these two groups ( $t_{(117)} = 0.57, p = 0.57$ ).

**Misrepresentation among CMGs with verifiable publications**

A sub-analysis of data for CMGs revealed no association between publication misrepresentation and age ( $p = 0.62$ ) or gender ( $p = 0.20$ ) (Table 3). Likewise, publication misrepresentation did not vary depending on prior academic degrees ( $p = 0.53$ ) (Table 3). This analysis was limited by the fact that only one of 89 applicants had completed a graduate degree. Nonetheless, this applicant did not misrepresent any citations. Similarly, misrepresentation did not vary with the number of citations per applicant ( $d.f. = 87, t = -0.15, p = 0.88$ ).

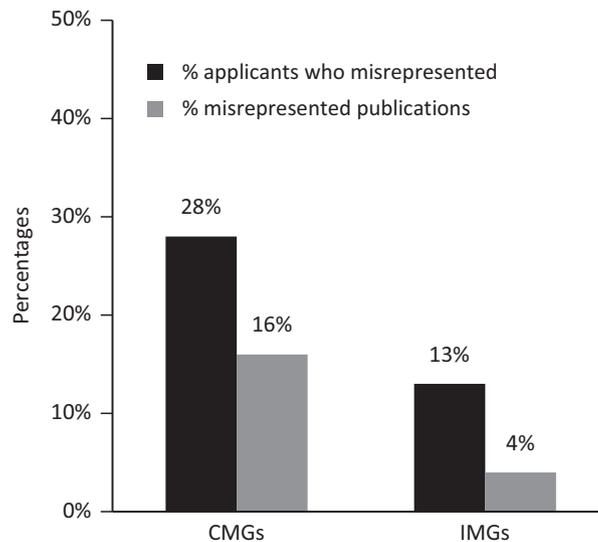
**DISCUSSION**

To our knowledge, this is the first nationwide study to examine the prevalence of publication misrepresentation amongst subspecialty residency applicants. Amongst verifiable scientific publications, 47 (12% of verifiable publications) were falsely reported by 29 applicants (24% of applicants reporting authorship). The most common types of publication misrepresent-

Table 2 Demographics of Canadian Resident Matching Service (CaRMS) 2006–2008 applicants to Canadian otolaryngology–head and neck surgery residency programmes claiming one or more verifiable publications

	All applicants with at least one verifiable publication ( <i>n</i> = 119/182) <i>n</i> (%)	Applicants not misrepresenting ( <i>n</i> = 90/119) <i>n</i> (%)	Applicants misrepresenting ( <i>n</i> = 29/119) <i>n</i> (%)	p-Value
Medical school				
CMGs	89 (75)	64 (71)	25 (86)	0.10
IMGs	30 (25)	26 (29)	4 (14)	
Age				
< 30 years	53 (45)	40 (44)	13 (45)	0.97
≥ 30 years	66 (55)	50 (56)	16 (55)	
Gender				
Male	84 (71)	66 (73)	18 (62)	0.25
Female	35 (29)	24 (27)	11 (38)	
Degree				
MD	117 (98)	88 (98)	29 (100)	0.42
MD + Masters ± PhD	2 (2)	2 (2)	0	

CMG, Canadian medical graduate; IMG, international medical graduate.



**Figure 3** Publication misrepresentation rates among Canadian medical graduates (CMGs) and international medical graduates (IMGs) among Canadian Resident Matching Service (CaRMS) 2006–2008 applicants to otolaryngology–head and neck surgery residency programmes

tation found were article non-existence (identified for 21 [72%] of 29 applicants who misrepresented), authorship self-promotion (identified for 7 [24%] of 29 applicants), and article non-authorship (identified for 1 [3%] of 29 applicants).

In comparison with the findings of previous studies of applicants to various residency and fellowship programmes, in both surgical and medical fields, our figures align with the higher end of the spectrum: more than two-thirds of studies report lower

Table 3 Demographics of CMGs applying to CaRMS 2006–2008 OTL-HNS residency programmes

	All applicants with ≥ 1 publication <i>n</i> = 89	Applicants without Misrepresentation <i>n</i> = 64/89	Applicants with Misrepresentation <i>n</i> = 25/89	p-Value
Age				
< 30 years	50 (56%)	37 (58%)	13 (52%)	0.62
≥ 30 years	39 (44%)	27 (42%)	12 (48%)	
Gender				
Male	59 (66%)	45 (70%)	14 (56%)	0.20
Female	30 (34%)	19 (30%)	11 (44%)	
Degree				
MD	88 (99%)	63 (98%)	25 (100%)	0.53
MD + Master's ± PhD's	1 (1%)	1 (2%)	0 (0%)	

rates of misrepresentation (Table S1).<sup>11,12,15–37</sup> The latter body of research includes studies in which applicant publications were reviewed only after applicants had been selected for interviews.<sup>11,26</sup> The resulting selection bias may perhaps explain the lower reported rates of publication misrepresentation. Likewise, other studies reporting fewer misrepresentations did not account for ‘in-press’ articles that had not been published despite allowing for a reasonable delay in time to publication,<sup>11,22,26,27,30,32,34</sup> and one study that did not consider unverifiable publications as misrepresentations still included them in its analysis.<sup>18</sup>

The types of publication misrepresentation found most commonly in our study (non-existing article > authorship self-promotion > non-authorship) are consistent with previously reported trends.<sup>20,24,26,28,32,37</sup> Among applicants who misrepresented, 72% listed a non-existing article in a verifiable journal; this percentage exceeds findings in previous reports in which such data were available.<sup>11,16,20,23,24,26,28,32,34,37</sup>

Previous studies of applicants to psychiatry, general surgery, ophthalmology and otolaryngology residency programmes showed significantly higher rates of misrepresentation in IMGs.<sup>16,32–34</sup> However, the inverse was true in the present study. Although our results did not reach statistical significance, the remarkably higher rate of misrepresentation amongst CMGs is worth noting. Applicant demographic characteristics (advanced age,<sup>33</sup> male gender<sup>16</sup>) and academic characteristics (higher number of reported citations<sup>18</sup>) previously shown to relate

to a higher likelihood of publication misrepresentation were also not replicated in the present study.

Several hypotheses may explain an individual’s impetus for misrepresenting his or her academic achievements. Some publication errors may have reflected an applicant’s misunderstanding of the academic credit he or she had been awarded. It is plausible that some applicants mistakenly assumed authorship subsequent to their involvement in a study, and that others who were originally listed as authors had been subsequently deleted without their knowledge. Taking the latter into consideration, the observation that only self-promotions were noted in our applicant pool is rather conspicuous as an equal distribution of authorship demotions and promotions might be assumed if errors were due to carelessness alone. Although it remains possible that we may have overlooked certain publications that were subject to prolonged delay in editing or time taken to come to press, this is less likely given the considerable window we afforded for delays in publication (5–7 years).

Although the exact reasons for the publication misrepresentations identified in our study cohort remain to be elucidated, it is possible to speculate, based on our findings, that some applicants may have purposefully altered their publication histories to render their applications more competitive. Indeed, our findings align with those of other studies in the literature. As Table S1 shows, publication misrepresentation has been described in applications to a broad array of surgical and medical specialties at various institutions. This raises questions

pertaining to professionalism in research or scholarship and the reasons that may drive medical students to inflate their credentials. Mushlin and Katz have speculated that the resident selection process may create a high-pressure environment that impels students to manipulate their applications in order to increase their likelihood of securing residency positions.<sup>38</sup> In addition to grades<sup>39–41</sup> and the interview process,<sup>40,41</sup> research publications<sup>39,41</sup> have consistently been identified as representing a significant criterion for distinguishing candidates with outstanding records. The act of identifying this particular dimension of performance as a focal area may have created a circumstance that inadvertently encourages misrepresentation.

A lack of explicit instruction in professionalism within the realm of professional practice may also account for errors in publication self-reporting. Medical students may have a poor understanding of academic credit and scholarly referencing, suggesting that professionalism may be learned 'through long-term continuity of experience'.<sup>42</sup> The fact that none of the applicants with advanced degrees in our study misrepresented their publication history supports this hypothesis, given that candidates with a graduate degree background may have a more sound understanding of what appropriate professional conduct, in terms of professional conduct in research, entails.

Likewise, in their study investigating academic dishonesty, Henning *et al.*<sup>43</sup> reported justifications similar to those mentioned previously as voiced by pharmacy and medical students. In a qualitative analysis of students' commentaries in reference to why they would engage in dishonest behaviour, common reasons included 'pressure from others', 'academic achievement (internal pressure to succeed)', 'poor time management', 'lack of morality', 'fear of failure', 'laziness', 'teaching and curriculum issues' and 'problems of understanding and awareness'. In an effort to limit this phenomenon, Henning *et al.* also analysed students' views regarding solutions. Most students proposed both constructive interventions and mechanisms relying on punitive systems overseen by faculty staff and institutional bodies. With deference to previous reports, we offer complementary recommendations that might deter publication misrepresentation and which merit further research.

The first of these measures includes addressing the application and admission process. For instance, publication status categories and their precise

definitions could be provided through CaRMS electronic application forms. Residency programmes could request the submission of copies of cited studies and letters of acceptance of publications listed as accepted or in press. Medical school admissions offices could outline criteria that reward honesty in addition to academic achievements, and could inform applicants that cited publications will be checked for authenticity and that a zero tolerance policy with regard to misrepresentation will be applied. Finally, helping students and residency admission committees understand that research publication is not the single most significant criterion in resident selection may diminish the urge to inflate credentials.

Other means of addressing publication misrepresentation relate to the teaching of professionalism. Jackson's anthropologic study of elementary schools in the 1960s introduced the notion of an informal channel for the communication of values and norms, which he coined 'the hidden curriculum'.<sup>44</sup> Stern applied this concept of formal and hidden curricula in his investigation into when professional values are taught in the hospital setting.<sup>45</sup> The study's findings demonstrated that the teaching of values was twice as likely to occur during an informal setting outwith scheduled teaching rounds and structured curricula. Furthermore, more than half of all value-related teaching was exchanged amongst residents and medical students without an attending physician present. These findings suggest that the informal curriculum, particularly in those instances involving residents, represents an opportune setting for the internalisation of key physician values by medical trainees. Similarly, a recent systematic review looking at the best evidence on how to teach professionalism in medicine concluded that it is learned most effectively through 'role modelling and personal reflections, ideally guided by faculty'.<sup>42</sup> Nonetheless, the authors highlight the difficulty in establishing the effectiveness of this approach, as well as the lack of consensus on the type of curriculum (general or tailored to each university) and the best method to teach professionalism in medicine.

In light of the current evidence, we are inclined to suggest a less didactic approach to teaching professionalism and to favour a role-modelling approach. In addition, the finding that faculty members lacked training in mentoring<sup>46</sup> suggests that providing them with guidance on mentorship may help them to nurture professionalism in their students, in both the clinical and the academic aspects of the profession, which should include an

appreciation of proper scholarly referencing and academic credit.

Our nationwide focus on applicants to Canadian otolaryngology–HNS residency programmes over multiple years permits the exploration of publication misrepresentation at a national level and thus benefits this study in comparison with previous studies based in single institutions. Given the possibility of publication delay, another strength of our study is the long follow-up period, which allowed for a 5–7-year window to publication. Finally, unlike most previous research, which studied cohorts over a maximum of 2 years, we extended our review of applications over a 3-year period (February 2006 to September 2008), further diminishing selection bias and rendering our results more generalisable.

Although we believe that the findings of this study represent a significant contribution to the literature, several limitations are worth noting. Our higher rate of unverifiable publications (10%) compared with previous reports may have underestimated the true prevalence of publication misrepresentation in our study sample as many of the unverifiable publications may also have been misrepresented. Indeed, 17 of the unverifiable citations referred to 11 journals not listed in the UPD, which may suggest the non-existence of the alleged journals and the claimed publications. Efforts to preserve applicant anonymity during data collection precluded the contacting of applicants who misrepresented, as was described by Beswick *et al.*<sup>16</sup> We can therefore only speculate on the intentions of those individuals who misrepresented.

---

## CONCLUSIONS

This is the first study, to our knowledge, to document the nationwide prevalence of publication misrepresentation amongst Canadian applicants to a single surgical subspecialty residency. The high rate of misrepresentation identified in our study highlights the ubiquitousness of this phenomenon and the need to better understand underlying factors in order to institute measures to curtail its occurrence. We offer means of addressing publication misrepresentation both through the application and admissions process, and through the teaching of professionalism.

---

*Contributors:* LS contributed to the design of the work and to the analysis and interpretation of data, and drafted the

paper. JSS contributed to the analysis and interpretation of data. SC contributed to the acquisition of data. MY contributed to the interpretation of data. LHPN contributed to the conception and design of the work, and the interpretation of data. All authors contributed to the critical revision of the paper and approved the final manuscript for publication.

*Acknowledgements:* the authors would like to thank the Canadian Residency Matching Service Research Committee, and medical librarian Robin Featherstone, Alberta Research Centre for Health Evidence, Department of Pediatrics, University of Alberta, Edmonton, AB, Canada, for her invaluable assistance with data acquisition.

*Funding:* none.

*Conflicts of interest:* none.

*Ethical approval:* this study was approved by McGill University and the Canadian Residency Matching Service.

---

## REFERENCES

- 1 Frank JR, Jabbour M, Fr chette D, Marks M, Valk N, Bourgeois G, eds. *Report of the CanMEDS Phase IV Working Groups*. Ottawa, ON: Royal College of Physicians and Surgeons of Canada 2005.
- 2 Louise L, Pam D, Neal C (April 24, 2013). Implementing Milestones and Clinical Competency Committees. [PowerPoint slides]. 2013 Accreditation Council for Graduate Medical Education. Available at: <https://www.acgme.org/acgmeweb/Portals/0/PDFs/ACGMEMilestones-CCC-AssesmentWebinar.pdf> (accessed 7th March 2015)
- 3 Epstein RM, Hundert EM. Defining and assessing professional competence. *JAMA* 2002;**287** (2):226–35.
- 4 Cruess RL, Cruess SR, Johnston SE. Renewing professionalism: an opportunity for medicine. *Acad Med* 1999;**74** (8):878–84.
- 5 Papadakis MA, Teherani A, Banach MA, Knetter TR, Rattner SL, Stern DT, Veloski JJ, Hodgson CS. Disciplinary action by medical boards and prior behaviour in medical school. *N Engl J Med* 2005;**353** (25):2673–82.
- 6 Hickson GB, Pichert JW, Webb LE, Gabbe SG. A complementary approach to promoting professionalism: identifying, measuring, and addressing unprofessional behaviours. *Acad Med* 2007;**82** (11):1040–8.
- 7 Cohen JJ. Professionalism in medical education, an American perspective: from evidence to accountability. *Med Educ* 2006;**40**:607–17.
- 8 Veloski JJ, Fields SK, Boex JR, Blank LL. Measuring professionalism: a review of studies with instruments reported in the literature between 1982 and 2002. *Acad Med* 2005;**80** (4):366–70.
- 9 Jha V, Bekker HL, Duffy SRG, Roberts TE. A systematic review of studies assessing and facilitating attitudes towards professionalism in medicine. *Med Educ* 2007;**41**:822–9.

- 10 Ginsburg S, Regehr G, Lingard L. Basing the evaluation of professionalism on observable behaviours: a cautionary tale. *Acad Med* 2004;**79** (10 Suppl):1–4.
- 11 Hebert RS, Smith CG, Wright SM. Minimal prevalence of authorship misrepresentation among internal medicine residency applicants: do previous estimates of 'misrepresentation' represent insufficient case finding? *Ann Intern Med* 2003;**138** (5):390–2.
- 12 Neuman SA, Long TR, Rose SH. Publication misrepresentation among anaesthesiology residency applicants. *Anesth Analg* 2011;**112** (3):674–7.
- 13 Canadian Resident Matching Service. Residency matches. <https://www.carms.ca/en/residency-matches>. [Accessed 27 March 2014.]
- 14 Canadian Resident Matching Service. Reports and statistics. R-1 Match Reports – 2013. <https://www.carms.ca/en/r-1-match-reports-2013>. [Accessed 11 May 2014.]
- 15 Larson JD, Sisolak BB, King TW. The presence of 'ghost' citations in an applicant pool of an integrated plastic surgery residency programme. *Plast Reconstr Surg* 2010;**126** (4):1390–4.
- 16 Beswick DM, Man LX, Johnston BA, Johnson JT, Schaitkin BM. Publication misrepresentation among otolaryngology residency applicants. *Otolaryngol Head Neck Surg* 2010;**143** (6):815–9.
- 17 Sekas G, Hutson WR. Misrepresentation of academic accomplishments by applicants for gastroenterology fellowships. *Ann Intern Med* 1995;**123** (1):38–41.
- 18 Gurudevan SV, Mower WR. Misrepresentation of research publications among emergency medicine residency applicants. *Ann Emerg Med* 1996;**27** (3):327–30.
- 19 Boyd AS, Hook M, King LE Jr. An evaluation of the accuracy of residency applicants' curricula vitae: are the claims of publications erroneous? *J Am Acad Dermatol* 1996;**35** (4):606–8.
- 20 Panicek DM, Schwartz LH, Dershaw DD, Ercolani MC, Castellino RA. Misrepresentation of publications by applicants for radiology fellowships: is it a problem? *AJR Am J Roentgenol* 1998;**170** (3):577–81.
- 21 Bilge A, Shugerman RP, Robertson WO. Misrepresentation of authorship by applicants to paediatrics training programmes. *Acad Med* 1998;**73** (5):532–3.
- 22 Dale JA, Schmitt CM, Crosby LA. Misrepresentation of research criteria by orthopaedic residency applicants. *J Bone Joint Surg Am* 1999;**81** (12):1679–81.
- 23 Baker DR, Jackson VP. Misrepresentation of publications by radiology residency applicants. *Acad Radiol* 2000;**7** (9):727–9.
- 24 Patel MV, Pradhan BB, Meals RA. Misrepresentation of research publications among orthopaedic surgery fellowship applicants: a comparison with documented misrepresentations in other fields. *Spine (Phila Pa)* 2003;**28** (7):632–6.
- 25 Cohen-Gadol AA, Koch CA, Raffel C, Spinner RJ. Confirmation of research publications reported by neurological surgery residency applicants. *Surg Neurol* 2003;**60** (4):280–3.
- 26 Roellig MS, Katz ED. Inaccuracies on applications for emergency medicine residency training. *Acad Emerg Med* 2004;**11** (9):992–4.
- 27 Katz ED, Shockley L, Kass L et al. Identifying inaccuracies on emergency medicine residency applications. *BMC Med Educ* 2005;**5**:30.
- 28 Yang GY, Schoenwetter MF, Wagner TD, Donohue KA, Kuettel MR. Misrepresentation of publications among radiation oncology residency applicants. *J Am Coll Radiol* 2006;**3** (4):259–64.
- 29 Gussman D, Blechman A. Verification of publications, presentations and posters by applicants to a residency in obstetrics and gynaecology. *J Reprod Med* 2007;**52** (4):259–61.
- 30 Konstantakos EK, Laughlin RT, Markert RJ, Crosby LA. Follow-up on misrepresentation of research activity by orthopaedic residency applicants: has anything changed? *J Bone Joint Surg Am* 2007;**89** (9):2084–8.
- 31 Glazer JL, Hatzenbuehler JR, Dexter WW, Kuhn CB. Misrepresentation of research citations by applicants to a primary care sports medicine fellowship programme in the United States. *Clin J Sport Med* 2008;**18** (3):279–81.
- 32 Caplan JP, Borus JF, Chang G, Greenberg WE. Poor intentions or poor attention: misrepresentation by applicants to psychiatry residency. *Acad Psychiatry* 2008;**32** (3):225–9.
- 33 Kuo PC, Schroeder RA, Shah A, Shah J, Jacobs DO, Pietrobon R. 'Ghost' publications among applicants to a general surgery residency programme. *J Am Coll Surg* 2008;**207** (4):485–9.
- 34 Wiggins MN. Misrepresentation by ophthalmology residency applicants. *Arch Ophthalmol* 2010;**128** (7):906–10.
- 35 Ishman SL, Smith DF, Skinner ML, Vigilar MV, Mettel TL, Cavey RM, Benke JR, Donahue RL, Ishii LE. Unverifiable publications in otolaryngology residency applications. *Otolaryngol Head Neck Surg* 2012;**147** (2):249–55.
- 36 Grimm LJ, Maxfield CM. Ultimate publication rate of unpublished manuscripts listed on radiology residency applications at one institution. *Acad Med* 2013;**88** (11):1719–22.
- 37 Wiggins MN. A meta-analysis of studies of publication misrepresentation by applicants to residency and fellowship programmes. *Acad Med* 2010;**85** (9):1470–4.
- 38 Mushlin SB, Katz JT. Academic integrity: 'accepted', 'in press' or unacceptable? *Acad Med* 2013;**88** (11):1598–9.
- 39 Green M, Jones P, Thomas JX Jr. Selection criteria for residency: results of a national programme directors survey. *Acad Med* 2009;**84** (3):362–7.
- 40 Makdisi G, Takeuchi T, Rodriguez J, Rucinski J, Wise L. How we select our residents – a survey of selection

- criteria in general surgery residents. *J Surg Educ* 2011;**68** (1):67–72.
- 41 Al Khalili K, Chalouhi N, Tjoumakaris S, Gonzalez LF, Starke RM, Rosenwasser R, Jabbour P. Programmes selection criteria for neurological surgery applicants in the United States: a national survey for neurological surgery programme directors. *World Neurosurg* 2014;**81** (3–4):473–7.
- 42 Birden H, Glass N, Wilson I, Harrison M, Usherwood T, Nass D. Teaching professionalism in medical education: a Best Evidence Medical Education (BEME) systematic review. BEME Guide No. 25. *Med Teach* 2013;**35** (7):1252–66.
- 43 Henning MA, Ram S, Malpas P, Sisley R, Thompson A, Hawken SJ. Reasons for academic honesty and dishonesty with solutions: a study of pharmacy and medical students in New Zealand. *J Med Ethics* 2013;**40** (10):702–9.
- 44 Jackson P. The student's world. *Elem Sch J* 1966;**66** (7):353.
- 45 Stern DT. In search of the informal curriculum: when and where professional values are taught. *Acad Med* 1998;**73** (10 Suppl):28–30.
- 46 Lown BA, Chou CL, Clark WD, Haidet P, White MK, Krupat E, Pelletier S, Weissmann P, Anderson MB. Caring attitudes in medical education: perceptions of deans and curriculum leaders. *J Gen Intern Med* 2007;**22** (11):1514–22.

---

 SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

**Figure S1.** Search strategy used to verify cited publications of CaRMS 2006 to 2008 applicants to OTL-HNS residency programmes, with the last article search done in October 2013.

**Figure S2.** Misrepresentation amongst CaRMS 2006 to 2008 applicants to OTL-HNS residency programmes with verifiable publications.

**Table S1.** Summary of publication misrepresentation studies amongst applicants to multiple residency programmes.

*Received 10 November 2014; editorial comments to author 21 January 2015, accepted for publication 4 February 2015*